was $11^h\ 40^m\ 33^s{\cdot}09$. The tabular longitude is therefore too large by $0''{\cdot}60$ according to this observation, when the clock errors are determined in the usual way. But if we determine the error of the sidereal clock, not from the stellar observations, but from the tabular R.A., which is the method mentioned by Professor Adams as that of the application of the equation of time, we shall find a sidereal time at noon larger by $0^s{\cdot}04$ than that found from the stellar observations. The difference of time thus found is, as Professor Adams remarks, very small; but the motion of the Sun in $0^s{\cdot}04$ is only about $0''{\cdot}00164$ in longitude; and this is the only effect produced by the change of time upon the tabular error of longitude, and is exactly the $\frac{1}{366}$th part of that required to remove the tabular error $0''{\cdot}60$.

Professor Cayley should certainly accept my results, for his conclusion is that I am right unless there are two mean Suns available (page 48, 7 lines from bottom); and Prof. Adams on page 44 distinctly states, "The only mean Sun known to astronomers is an imaginary body, which moves uniformly in the equator at such a rate that the difference between its Right Ascension and that of the true Sun consists wholly of periodic quantities." I agree that this is our present usage.

In conclusion, I merely call attention to the fact that in my work I use tabular days T_1 and T_2, such that Sun's true mean longitude $=A+n_1t_1=A+n_2t_2$, where n_1 and n_2 are assigned angles, and T_1 T_2 are the corresponding adopted units. The advantage of this method is that we can correctly allow for the change of unit due to a change from n_1 to n_2 in the adopted value of the Sun's mean motion in longitude, for

$$\frac{T_1-T_2}{T_2}=\frac{n_1-n_2}{n_2}$$

is determinate. Attempts to measure motion in fallible units of the time used as our independent variable cannot but lead to error.

Remarks on Major-General Tennant's paper "On the Change in the adopted Unit of Time." By Prof. J. C. Adams, M.A., F.R.S.

The December number of the *Monthly Notices* contains a paper by Major-General Tennant in which the author arrives at conclusions which appear to him to confirm Mr. Stone's views respecting a change in the unit of mean solar time. In reality, however, those conclusions are quite consistent with my own as given in the same number of the *Monthly Notices*, and not at all with Mr. Stone's.

According to Major-General Tennant (*Monthly Notices*, p. 43), the factor by which the tabular mean motions should be multiplied in consequence of the change from Bessel's to Le Verrier's determination of the ratio of the mean solar to the sidereal day is what he calls

$$\frac{\text{Sidereal Seconds in Le Verrian Mean Day}}{\text{Sidereal Seconds in Besselian Mean Day}}.$$

Now, if n be the Sun's mean motion in a mean solar day as determined by Bessel, the sidereal seconds in a mean solar day will be

$$86400 \times \frac{360^\circ + n}{360^\circ}.$$

But if $n + \delta n$ be the Sun's mean motion in a mean solar day as determined by Le Verrier, the sidereal seconds in a mean solar day will be

$$86400 \times \frac{360^\circ + n + \delta n}{360^\circ},$$

and therefore the factor above referred to by Major-General Tennant will be

$$\frac{360^\circ + n + \delta n}{360^\circ + n} = 1 + \frac{\delta n}{360^\circ + n},$$

whereas, according to Mr. Stone's views, this factor should be

$$\frac{n + \delta n}{n} = 1 + \frac{\delta n}{n},$$

where the difference from 1 is nearly 366 times greater than it should be.

The same thing may be otherwise shown thus:—

If N denote the number of mean solar days in a mean tropical year, according to Bessel's determination, then $N + 1$ will be the corresponding number of sidereal days in the same interval.

Consequently, the ratio of the length of a mean solar to that of a sidereal day will be

$$\frac{N + 1}{N} = 1 + \frac{1}{N}.$$

But if $N + \delta N$ denote the number of mean solar days in a mean tropical year, according to Le Verrier's determination, then $N + \delta N + 1$ will be the corresponding number of sidereal days in the same interval.

And consequently the above-mentioned ratio will become

$$\frac{N + \delta N + 1}{N + \delta N} = 1 + \frac{1}{N + \delta N}$$

Hence the ratio of the length of a mean solar to that of a sidereal day will be changed in the ratio of

$$\frac{1 + \dfrac{1}{N + \delta N}}{1 + \dfrac{1}{N}} = 1 - \frac{\delta N}{N(N + 1)}, \text{ nearly,}$$

whereas, according to Mr. Stone, the ratio which measures this change would be

$$\frac{N}{N+\delta N} = 1 - \frac{\delta N}{N}, \text{ nearly,}$$

where, as before, the difference from 1 is nearly 366 times too great.

Mr. Stone's error appears to arise from his *equating* two things which are really different, and which are inconsistent with each other,—viz. Bessel's and Le Verrier's determinations of the Sun's mean motion in longitude in the same interval of time.

Major-General Tennant is wrong in supposing that solar observations are no longer employed in Observatories for the determination of mean solar time. If this were the case, it would only show that the Observatories had taken a very retrograde step, since the final test whether the mean solar times have been correctly found can only be supplied by solar observations. Whenever the mean solar times are deduced from the observed sidereal times, it is tacitly assumed that the tabular mean longitudes of the Sun which have been employed are correct; and if this is not the case, the mean solar times deduced will require a corresponding correction, which can only be found by solar observations.

Thus mean solar time may be determined with reference to a natural phenomenon,—viz. the transit of the true Sun over the meridian of a given place; and the mean solar day is the average of all the apparent solar days defined as the intervals between two successive transits, and therefore has nothing arbitrary about it. To speak of Besselian mean time and Le Verrian mean time, or of the Besselian mean solar day and the Le Verrian mean solar day, can produce nothing but confusion in our ideas of the measure of time.

Additional Note on the Change in the Unit of Time.

By Prof. A. Cayley, M.A., F.R.S.

Bessel's mean Sun is what Bessel supposed the mean Sun to be: that is, a point in the heavens the mean longitude of which is

$$l = \text{const.} + 1296027''\cdot618184 \,.\, t + \text{term in } t^2,$$

the longitude being measured from what Bessel supposed to be the mean equinoctial point, and the unit of time being what Bessel supposed to be the Julian year of 365·25 mean solar days.

Similarly Hansen's mean Sun is what Hansen supposed the mean Sun to be: that is, a point in the heavens the mean longitude of which is

$$l = \text{const.} + 1296027''\cdot674055 \,.\, t + \text{term in } t'^2,$$